TF 2103

TF 2103
Wide Range Oscillator

INSTRUCTION MANUAL

mi

MARCONI INSTRUMENTS

MANUAL CHANGE
for
WIDE RANGE OSCILLATOR
TF 2103

The following changes refer to current production and are due to the use of a new mains power unit.

Chapter 2, page 3 : Replace Fig. 2 with new diagram below

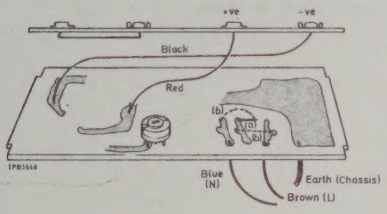


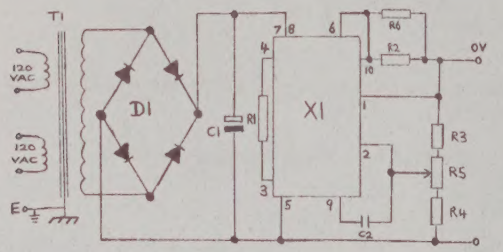
Fig. 2 Mains power unit :
Voltage setting selector (link 'a' for 200/250 V, 'b' for 100/125 V).

Chapter 6, page 4 : Insert parts list for mains power unit below VT7, 8.

MAINS POWER UNIT TM 9808

C1	470μF 40V	TM 9808FPP/X52501/22
C2	1000pF	TM 9808FPP/X20641/6
D1	Rectifier W005	TM 9808FPP/Z20648/11
R1	1.8kΩ 5% $\frac{1}{4}$W	TM 9808FPP/X50517/28
R2,6	10Ω 5% $\frac{1}{4}$W	TM 9808FPP/X50517/1
R3	3.9kΩ 5% $\frac{1}{4}$W	TM 9808FPP/X50517/32
R4	2.7kΩ 5% $\frac{1}{4}$W	TM 9808FPP/X50517/30
R5	1kΩ variable	TM 9808FPP/X20999/58
T1	Transformer	TM 9808FPP/X53415
X1	Integrated circuit μ723	TM 9808FPP/X50520/95

Chapter 7, page 3/4 : Substitute new circuit diagram of mains power unit TM 9808 :



MAINS POWER UNIT TM 9808

Wide Range Oscillator TF 2103

Code No. 52103-900V

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1977

MARCONI INSTRUMENTS LTD.
ST. ALBANS HERTFORDSHIRE ENGLAND

NOTES AND CAUTIONS

SAFETY PRECAUTIONS

This equipment is protected in accordance with IEC Safety Class 1. It has been tested according to IEC Publication 348, 'Safety Requirements for Electronic Measuring Apparatus, and has been supplied in a safe condition. The following precautions must be observed by the user to ensure safe operation and to retain the equipment in a safe condition.

Defects and abnormal stresses

Whenever it is likely that protection has been impaired, for example as a result of damage caused by severe conditions of transport or storage, the equipment shall be made inoperative and be secured against any unintended operation.

Removal of covers

Removal of the covers is likely to expose live parts although reasonable precautions have been taken in the design of the equipment to shield such parts. The equipment shall be disconnected from the supply before carrying out any adjustment, replacement or maintenance and repair during which the equipment shall be opened. If any adjustment, maintenance or repair under voltage is inevitable it shall only be carried out by a skilled person who is aware of the hazard involved.

Note that capacitors inside the equipment may still be charged when the equipment has been disconnected from the supply. Before carrying out any work inside the equipment, capacitors connected to high voltage points should be discharged; to discharge mains filter capacitors, if fitted, short together the L (live) and N (neutral) pins of the mains plug.

Mains plug

The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. The protective action shall not be negated by the use of an extension lead without protective conductor. Any interruption of the protective conductor inside or outside the equipment is likely to make the equipment dangerous.

Fuses

Note that the supply fuse is connected in series with the brown (live) wire of the supply lead. If the equipment is connected to the supply via a two-pin plug, it will be possible for the fuse to become connected to the neutral side depending upon the orientation of the plug in its socket. In these circumstances certain parts of the instrument could remain at supply potential even after the fuse has ruptured.

To provide protection against breakdown of the supply lead, its connectors, and filter where fitted, an external supply fuse (e.g. fitted in the connecting plug) should be used in the live lead. The fuse should have a continuous rating not exceeding 6 A.

Make sure that only fuses with the required rated current and of the specified type are used for replacement. The use of mended fuses and the short-circuiting of fuse holders shall be avoided.

RADIO FREQUENCY INTERFERENCE

This equipment conforms with the requirements of EEC Directive 76/889 as to limits of r.f. interference.

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PRELIMINARIES

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7 Servicing diagrams

Note ...

Each page bears the date of the original issue or the code number and date of the latest amendment (Am. 1, Am. 2 etc.). New or amended material of technical importance introduced by the latest amendment is indicated by triangles positioned thus ▶.....◀ to show the extent of the change. When a chapter is reissued the triangles do not appear.

Any changes subsequent to the latest amendment state of the manual are included on inserted sheets coded C1, C2 etc.

Chapter 1

GENERAL INFORMATION

CONTENTS

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1 Introduction
4 Performance data
10 Optional accessories

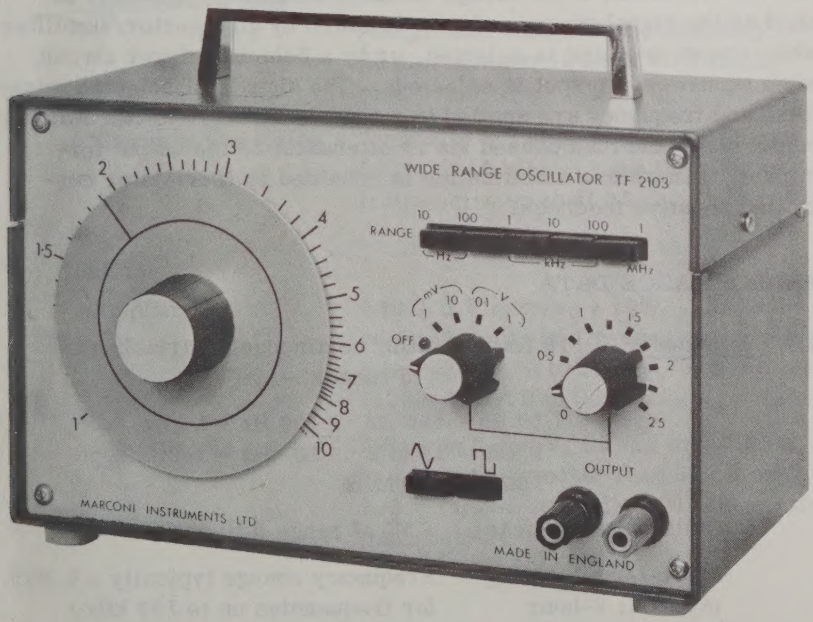

Fig. 1 Wide Range Oscillator TF 2103

INTRODUCTION

1. The output frequency of this compact sinewave/squarewave portable oscillator is continuously variable within the band 10 Hz to 1 MHz. A bank of five range-selecting push-buttons and a clearly calibrated dial are used to set the output frequency; the effective scale length for the band exceeds 1 m. Output signal amplitude is continuously variable in four switched ranges from 0 to 2.5 V r.m.s.

2. The instrument is powered by two internal 0 V batteries - or, if mains operation is preferred, the batteries may be replaced by a Mains Power Unit type TM 9808 which is available as an optional extra. In either case an l.e.d. pilot light indicates the presence of the d.c. supply rail voltage.

3. A transistor Wien-bridge variable frequency oscillator is used as the signal source; this is followed by an inverter/amplifier when sinewave output is selected, or by a Schmitt trigger circuit when squarewave output is selected. The signals of selected waveform and frequency are applied to a complementary emitter follower output stage and then passed via an attenuator to the output terminals. Amplitude stabilization is provided by thermistor controlled negative feedback.

PERFORMANCE DATA

4. Frequency : 10 Hz to 1 MHz, continuously variable in 5 ranges :-

10 Hz - 100 Hz	100 Hz - 1 kHz
1 kHz - 10 kHz	10 kHz - 100 kHz
100 kHz - 1 MHz	

Calibration accuracy : ± 3% of range full-scale.

Short-term stability (Approx. 2-hour period) : Frequency change typically ± 0.05% for frequencies up to 100 kHz.

Frequency change typically ± 0.2% for frequencies from 100 kHz to 1 MHz.

Frequency supply variation : For 10% variation in battery voltage, each range :-

Less than ± 0.1% change in frequency at scale setting '1'.
Typically ± 1% change in frequency at scale setting '10'.

Frequency/temperature variation : Typically less than ± 0.05% per °C at 20°C.

5. Waveform : Sinewave or squarewave

Squarewave rise time : Not greater than 100 ns, typically 50 ns,(between 10% and 90% amplitude points).

Sinewave distortion : Typically 0.5% for frequencies from 50 Hz to 10 kHz. Less than 2% for frequencies up to 100 kHz.

6. Output

Amplitude : 0 to 2.5 V r.m.s. ± 10%. Continuously variable in 4 ranges :-
0 to 2.5 mV, 0 to 25 mV, 0 to 0.25 mV and 0 to 2.5 V.

Impedance : 600 Ω on 2.5 mV, 25 mV and 0.25 V ranges. Not greater than 600 Ω on 2.5 V range; typically 100 Ω at maximum output.

Note ...

The attenuator is frequency compensated to feed a high impedance load. If excessive capacitance is connected across the output a fall-off in high frequency response will result.

7. Temperature range : 0^{o} to $+45^{o}$ C.

8. Power supply : Two series-connected 9 V batteries (not supplied) : Vidor type VT9 or Ever Ready type PP9 or equivalent. (Mains power unit is optional extra).

Minimum supply voltage : 12 V d.c.

Consumption : 0.4 W (25 mA, 16 V).

9. Dimensions and weight

Height : 211 mm ($8\frac{1}{2}$ in)
Width : 127 mm (5 in)
Depth : 120 mm (4 3/4 in)
Weight : 1.1 kg (2.7 lb) without batteries
1.9 kg (4.6 lb) with batteries.

OPTIONAL ACCESSORIES

10. Mains Power Unit TM 9808, MI code 44990-118X.

Chapter 2

INSTALLATION

CONTENTS

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1 Power supply requirements
2 Fitting batteries
5 Mains power unit connections
6 Mains power unit voltage setting
7 Fitting the mains power unit

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1 Location of access screws 2
2 Voltage setting selector 2

POWER SUPPLY REQUIREMENTS

1. TF 2110 is powered by two internal 9 V batteries (not supplied). If mains operation is preferred, the batteries may be replaced by a Mains Power Unit TM 9906 which is available as an optional extra.

FITTING BATTERIES

2. To gain access to the battery compartment first set the OUTPUT switch to OFF. Remove the screw at each side of the unit and lift off the instrument lid. The battery compartment is situated in the right hand rear corner.

3. Insert two batteries type VT9, PP9 or equivalent with terminals uppermost. The '+' terminal of each battery should be nearer to the right hand side of the instrument (i.e. the side adjacent to the RANGE push-buttons).

4. Connect the batteries into circuit using the two flying connectors provided; then replace and secure the instrument lid.

MAINS POWER UNIT CONNECTIONS

5. First ensure that a suitable mains plug is fitted to the mains lead attached to the power supply unit. The three conductors are colour coded as follows :-

BROWN	-	Live
BLUE	-	Neutral
GREEN/YELLOW	-	Earth

CAUTION Do not connect the TM 9808 to the mains supply unless it is first ascertained that the voltage setting is correctly selected, as below, and that the TM 9808 is correctly installed in the TF 2103.

MAINS POWER UNIT VOLTAGE SETTING

WARNING No provision is made for switching off the mains voltage to the TM 9808. Therefore if the unit is to be removed from the TF 2103 first disconnect the mains supply voltage.

6. TM 9808 is normally supplied set for 200/250 V mains operation. To change the voltage setting proceed as follows :-

(1) First disconnect the mains power supply.

(2) Remove the four screws (reference A) in Fig. 1 and raise the top plate which is joined by two wires to the internal circuit.

(3) The mains link (Fig. 2) should be soldered in position 'b' for 100/125 V operation (or position 'a' for 200/250 V operation).

(4) Replace and secure the top plate.

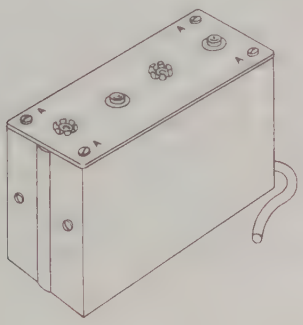

Fig. 1 Mains power unit: location of access screws (A)

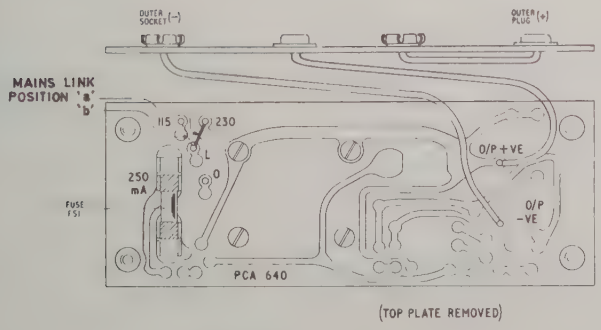

Fig. 2 Mains power unit: voltage setting selector

FITTING THE MAINS POWER UNIT

7. Check that the power supply is disconnected and that the OUTPUT switch is set to the OFF position. Raise the unit from the case and remove the blind grommet from the slot in the lower edge of the rear panel.

8. Insert the TM 9808 into the battery compartment via the open side (mains-lead end to enter first). Pass the mains lead along the compartment and out via the slot in the rear panel. A rubber grommet is provided on the mains lead; slide this along the lead and insert it into the rear panel slot.

9. Lower the unit into the case and connect it into circuit using the two flying connectors provided. Replace and secure the instrument lid.

Chapter 3

OPERATION

OPERATING PROCEDURE

1. Switch on the supply by turning the OUTPUT switch to any one of the amplitude ranges and check that the pilot lamp glows.

2. If the lamp does not glow clearly, disconnect the supply and follow the instructions given in Chap. 5, para. 3: renew the batteries (or TM 9808) if the required voltage is not obtained, then replace and secure the instrument lid.

3. Set the output amplitude to the required level using the OUTPUT switch and multiplier control which is scaled 0 to 2.5. (The output signal amplitude is given by :- OUTPUT switch setting x multiplier setting.)

4. Depress the push-button marked with the required waveform i.e. sinewave or squarewave. (The push-button should lock in the depressed position.)

5. Depress the appropriate frequency RANGE push-button. (The push-button should lock in the depressed position.)

6. Turn the dial to select the required output frequency. The output frequency is given by :- Dial setting x lower limit of selected range (e.g. with dial set to 2 and the 10 to 100 kHz range selected, the output frequency is 2 x 10 kHz = 20 kHz).

7. The selected signals are available at the OUTPUT terminals : the black terminal is provided as the common (supply +) connection,

the red as the 'high' signal-line.

Note ...

After using the instrument, ensure that the OUTPUT switch is returned to OFF in order to conserve the battery voltage. When a TM 9808 is employed, the mains supply to the unit is maintained unless the supply is externally switched (see warning in Chap. 2, para. 5).

Chapter 4

TECHNICAL DESCRIPTION

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1 Overall description
6 Inverter amplifier
7 Schmitt trigger
10 Output stage

OVERALL DESCRIPTION

1. TF 2103 employs a variable frequency oscillator followed by an inverter/amplifier when sinewave output is selected, or by a Schmitt trigger circuit when squarewave output is selected. The signals of selected waveform and frequency are applied to a complementary emitter follower output stage and then pass via an attenuator to the output terminals. Amplitude stabilization is provided by thermistor-controlled negative feedback.

2. The signal source is a Wien-bridge oscillator comprising transistors VT1 and VT2 connected to form a feedback pair and VT3 as an emitter follower oscillator-output stage. Gain of the VT1, VT2 combination is set by R10 and R11.

3. The fine frequency control comprises the semi-precision ganged potentiometers RV2 and RV4 which vary the resistive bridge-elements. Range selecting is effected by switching into circuit highly stable capacitors. On ranges 1 to 4 (10 Hz - 100 kHz) the

series limb of the Wien-bridge network comprises capacitor C9, 10, 11 or 12 (as selected by push-button SD, SE, SF or SG) with RV6, RV4 and R9, whilst the shunt limb comprises capacitors C4, 5, 6 or 7 (as selected by push-button SD, SE, SF or SG) with RV2, RV1 and R8. A capacitor C23 in series with C7 is used to compensate for the effect of stray capacity. Resistors R32 and R33 are included only when compensation for variations in the normal resistance laws of RV2 and RV4 is necessary. The settings of RV1 and RV6 determine the accuracy of calibration at the upper frequency end of the ranges.

4. On range 5 (100 kHz - 1 MHz) the frequency-determining capacitors are C8 trimmed by C16 (shunt-limb) and C13 trimmed by C17 (series-limb); the capacitors are selected by push-button SH. The trimmers C16 and C17 enable allowance to be made for circuit stray capacitance. For this range RV3 is switched in parallel with RV1, and RV5 in parallel with RV6.

5. The bias supply for VT1 base is provided by the potential divider R1/MR1-3 connected across the supply.

INVERTER AMPLIFIER

6. This stage, used only on sinewave operation to pass oscillator signals to the output stage, comprises VT4 which is biased by means of R5 and R15. Potentiometer RV7 serves as a preset sinewave amplitude control. Negative feedback is introduced since R16 is not by-passed.

SCHMITT TRIGGER

7. The Schmitt trigger circuit, or squarer, consists of the switching transistors VT7 and VT8. Output signals of rectangular waveform are produced at the collector of VT8 when sinusoidal oscillator output signals are applied to the base of VT7.

8. The silicon diode MR4 functions as a voltage regulator; it controls the d.c. voltage applied to the base and collector circuits

of VT7 and ensures that the squarewave amplitude is held constant for variations of supply voltage. The potentiometer RV8 serves as a preset trigger level (or mark/space ratio) control: RV9 controls the collector voltage of VT8 and with MR5 functions as a preset amplitude control for the squarewave output. Resistors R22 and R24, supplied by the collector output of VT7, serve as a potential divider for the base of VT8.

9. Use of this type of circuit ensures that fast rise and fall times are obtained for the output pulse, the times being independent of signal frequency.

OUTPUT STAGE

10. This stage comprises transistors VT5 (pnp) and VT6 (npn) connected in a complementary emitter follower configuration which provides an output impedance of approximately 100 Ω and maintains the fast rise and fall times of the waveform presented by the Schmitt trigger circuit on squarewave operation. The transistors are biased by means of R6, MR6 and MR7.

11. In the output circuit C3 functions as a blocking capacitor. The switched attenuator, comprising R25-30 and the frequency compensating capacitors C14 and 15, is connected to the slider of the variable output control RV10 and provides attenuation factors of 20, 40 and 60 dB. The attenuator has an output impedance of 600 Ω.

Chapter 5

MAINTENANCE

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1 Introduction
2 Performance tests
3 Supply voltage measurements
4 Sinewave adjustments
5 Squarewave adjustments
6 Fault finding
7 Localized fault tracing
13 Notes on fault correction
14 Realignment

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2 Waveforms 6

INTRODUCTION

1. This chapter contains information on preventative maintenance, fault finding and repair. In case of difficulties which cannot be resolved with the aid of this manual please contact our Service Division at the address stated on the back cover, or your nearest Marconi Instruments representative quoting the type and serial number of the instrument.

Notes ...

(1) Test procedures described are simplified and of restricted range compared with those which would be needed to demonstrate complete compliance with the specifications. They should be regarded only as providing a check procedure, for use during routine maintenance, to determine whether adjustment or repair is necessary.

(2) The performance limits quoted are for guidance and should not be taken as guaranteed performance specifications unless they are also quoted in the Performance Data in Chap. 1.

(3) When making tests to verify that the instrument meets the stated performance limits, allowance must always be made for the uncertainty of the test equipment used.

TABLE 1 TEST EQUIPMENT REQUIRED

Description	Minimum use specifications	Recommended model
Multimeter	10 kΩ/V	Selectest Super 50
Oscilloscope	10 Hz to 10 MHz	
Counter	10 Hz to 1 MHz	MI TF 2430

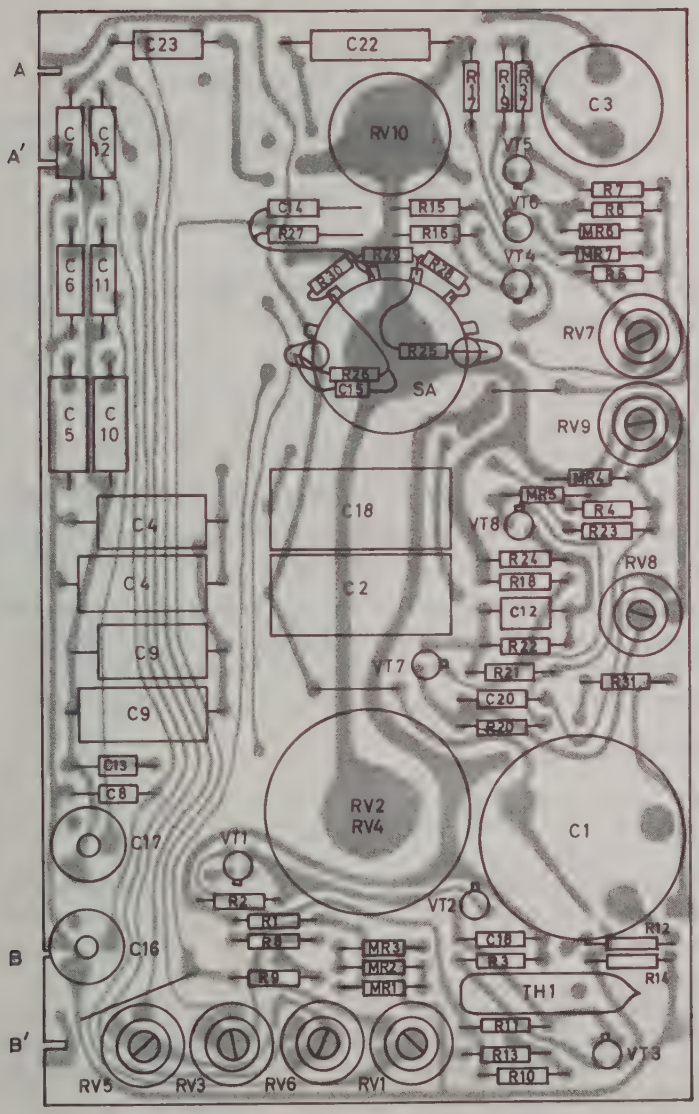

Fig.1 Component layout

PERFORMANCE TESTS

2. The instrument is fully aligned and tested prior to despatch. Instructions on routine adjustments are given below, but if it should become necessary to fully re-align the instrument, appropriate instructions are detailed in para. 14.

Supply voltage measurements

3. To check the supply voltage when using either batteries or the mains voltage unit proceed as follows :-

(1) Remove the two case-securing screws (one from each side of the unit) and lift off the instrument lid.

(2) Set the OUTPUT switch to any one of its four ranges.

(3) Using a multimeter check the voltage between the two outer connections of the series-connected batteries (or of the TM 9808 when fitted).

(4) For general operation of the instrument the supply voltage should not be less than 12 V; however, any adjustment or alignment of the instrument should be made with a supply of not less than 17 V.

Sinewave adjustments

4. The sinewave amplitude can be checked and adjusted as follows :-

(1) Measure the supply voltage in accordance with para.3 For the purpose of this adjustment the supply voltage should not be less than 17 V.

(2) Remove the unit from the case.

(3) Set the OUTPUT switch to 1 and the multiplier to 2.5. Depress the 'Sinewave' push button: the control should lock in the depressed position.

(4) Select RANGE 3 (1 - 10 kHz) and set the dial to '1'.

(5) Adjust potentiometer RV7 for an output signal amplitude of 2.5 V r.m.s. Take care that only the correct control is adjusted - see Fig. 1 for location.

Squarewave adjustments

5. The squarewave amplitude and mark/space ratio can be checked and adjusted as follows :-

(1) Measure the supply voltage in accordance with para. 3. For the purpose of these adjustments the supply voltage should not be less than 17 V.

(2) Remove the unit from the case.

(3) Set the OUTPUT switch to 1 and the multiplier to 2.5.

(4) Select RANGE 3 (1-10 kHz) and set the dial to 1.

(5) Depress the 'Squarewave' push-button; the control should lock in the depressed position.

(6) Adjust potentiometer RV9 for a signal amplitude of 5 V peak-to-peak; the control is situated on the printed circuit board immediately behind the 'Sinewave' push-button. Adjust potentiometer RV8 for a mark-to-space ratio of 1 : 1.

Note ...

Two positions on the control may yield a 1 : 1 mark-to-space ratio ; the position used for the setting should be that nearer to the anti-clockwise end of the track.

FAULT FINDING

6. To locate a fault, first try to identify the faulty stage by making a systematic check of waveforms (see Fig. 2) and d.c. voltages (see Table 2).

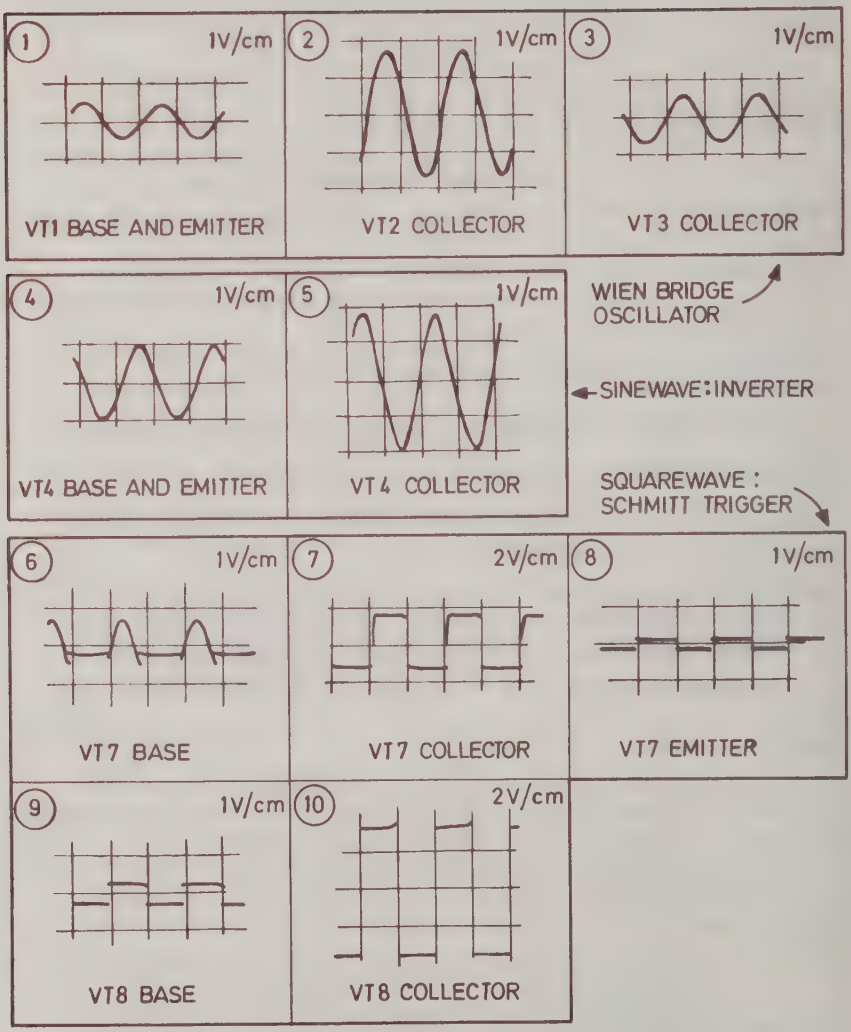

Fig. 2a Waveforms

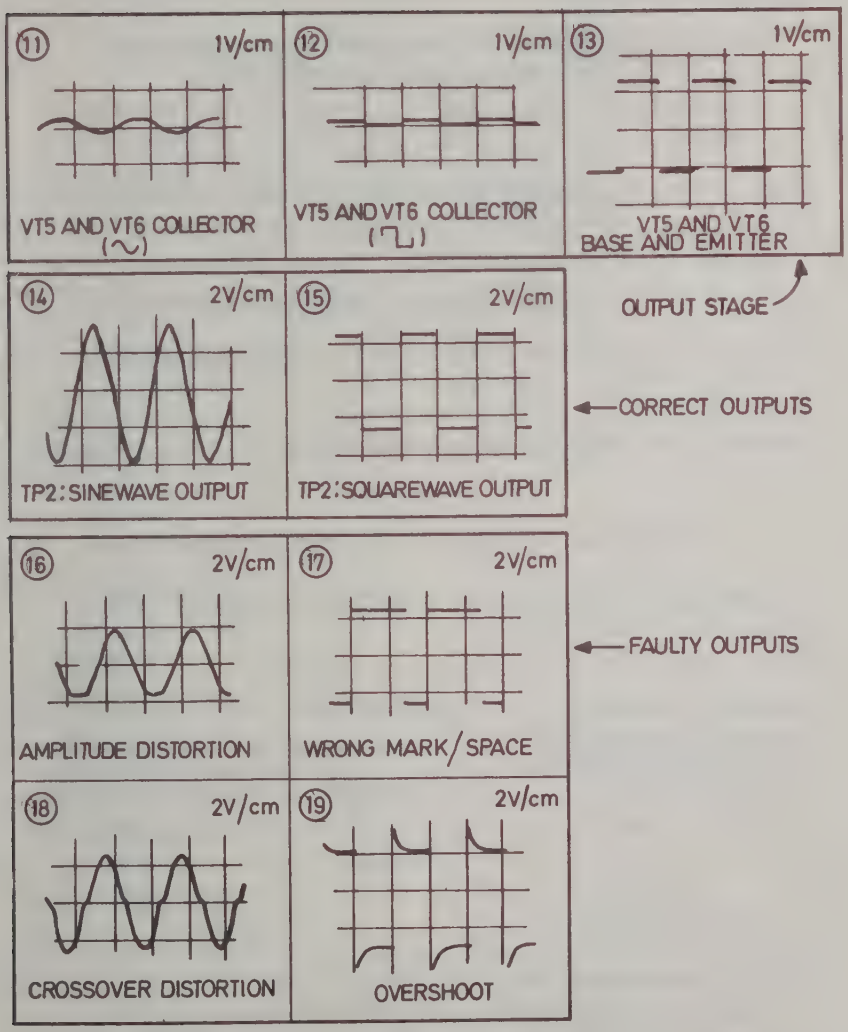

Fig. 2b Waveforms

Localized fault tracing

7. Having traced the fault to a particular region, follow the instructions given in the appropriate paragraph below.

8. Oscillator

(1) Observe the waveforms at VT1 base and emitter, and at the collectors of VT2 and VT3; compare with waveforms 1, 2 and 3 of Fig. 2 (a).

(2) Check the d.c. conditions of the oscillator - see Table 2.

(3) Check the thermistor (TH1) and the ganged potentiometers RV2 and RV4.

9. Examples of oscillator faults are as follows :-

Symptom	Possible cause
No oscillation or amplitude of sinewave markedly reduced.	Thermistor short-circuited.
Clipping of sinewave.	Thermistor open-circuited.
HF oscillations on fundamental sinewave.	Capacitance of C19 too low. (Increase from 10pF to 22pF).
Intermittent oscillation.	Hair-line crack in copper of printed circuit; or dry joint.

10. Schmitt trigger

(1) With 'Squarewave' selected, observe the waveforms at the base, emitter and collector of VT7, and at the base and collector of VT8; compare with waveforms 6 to 10 in Fig. 2(a).

(2) Check the d.c. conditions of the Schmitt trigger stage - see Table 2.

11. Examples of Schmitt trigger faults are as follows :-

Symptom	Possible cause
Mark/space ratio incorrect (e.g., waveform 17).	RV8 defective; adjust or replace.
Amplitude incorrect.	RV9 defective; adjust or replace.
Top of squarewave, at VT8 collector, concave.	MR4 operation unstable; check h.t. supply and diode.

12. Amplifier/inverter

With 'Sinewave' selected, observe the waveforms at the base, emitter and collector of VT4; compare with waveforms 4 and 5 in Fig. 2 (a).

13. Examples of amplifier/inverter faults are as follows :-

Symptom	Possible cause
Overshoot on squarewave output (e.g., waveform 19).	C14 or C15 defective.
Output amplitude (sine or squarewave) incorrect for one or more positions of the OUTPUT switch.	Defective attenuator resistors; check circuit and values.

Notes on fault correction

14. Having identified the fault the following precautions should be observed.

(1) Do not remove components unnecessarily. When removing or inserting a component a heat sink (e.g., pliers) should be used to prevent damage to the component due to heat from the soldering iron.

(2) When removing or inserting components ensure that the supply is OFF, otherwise high voltage surges may damage the transistors.

(3) When heating connections on a printed circuit board, keep the board in a horizontal plane to prevent solder from flowing across the printed circuit.

(4) If the bias of a transistor is incorrect, check the biasing components; an open circuit joint or a resistor no longer within the required tolerance may be the cause.

(5) If a transistor is found to be faulty, check the associated components.

(6) After changing components check the calibration and operation of the instrument; if incorrect, re-align - see para. 15.

TABLE 2 DC VOLTAGES

Voltages listed are typical values measured relative to chassis earth with a multimeter (or with an oscilloscope when marked 'CRO')

∿/⊓ Setting	Transistor	V_e	V_b	V_c
∿ or ⊓	VT1(CRO)	-1.6V	-2V	-16.5V
	VT2(CRO)	-17V	-16.5V	-8V
	VT3(CRO)	-7.5V	-8V	-17V
∿	VT4	-1.7V	-2V	-8.5V
	VT5	-9.5V	-9.7V	-17V
	VT6	-9.3V	-8.5V	0
⊓	VT5	-4.2V	-4.5V	-17V
	VT6	-3.7V	-3.2V	0
	VT7	-0.35V	-0.36V	-2V
	VT8	-0.35V	-0.6V	-3.2V

Junction of MR1 and R1 : -2V
Junction of MR4 and R4 : -8.7V

REALIGNMENT

15. The following procedure enables the instrument to be re-calibrated after repair.

(1) Remove the unit from its case.

(2) Switch the supply ON by turning the OUTPUT switch clockwise.

(3) Check the output voltage of batteries or mains power unit; this should not be less than 17 V for the purpose of alignment. The output ripple voltage of the mains power unit should not exceed 1 mV.

(4) Using a small screwdriver set potentiometers RV1, RV3, RV5, RV6, RV8 and RV9 to approximately their mid-track positions - see Fig. 1 for location.

(5) Select 'Sinewave' and ensure that all frequency range push-buttons are out.

(6) Set the OUTPUT switch to 1 V and the multiplier to 2.5.

(7) Loosen the grub screws on the slow motion drive and gently tighten one screw.

(8) Set to range 3 (1kHz - 10 kHz) and adjust the indicated frequency to 988 Hz using a counter. Ensure the output is 2.5 V r.m.s. by setting RV7. Note on the oscilloscope that there is no clipping of the waveform.

(9) Loosen the grub screw, set the dial to 1.

(10) Re-tighten gently and turn the dial to 10.

(11) Adjust RV1 and RV6 for an indication of 10 000 Hz and 2.5 V r.m.s.

(12) Check range 4 (10 kHz - 100 kHz) is within calibration and, if not, note errors.

(13) Check range 2 (100 Hz - 1 kHz) and again note errors.

(14) Check range 1 (10 Hz - 100 Hz) and note errors.

(15) Reset to range 3 and readjust, taking into account errors on ranges 1, 2 and 4. Use RV1 and RV6 for full-scale adjustment and the grub screw for adjustment of low settings.

(16) Repeat sequence 11 to 14 until best settings are obtained.

(17) On range 3 check the main calibration markers, i.e. 1.5, 2, 3, 6 and 9. If necessary make further slight adjustment to RV1 and RV6 and the grub screw.

(18) When satisfied tighten both grub screws.

(19) Set to range 5 (100 kHz - 1 MHz).

(20) Set the dial to 1 and adjust C16 and C17 to indicate 98.500 Hz and ensure that the output is 2.5 V r.m.s. This requires setting C16 and C17 alternately.

(21) Set the dial to 10 and adjust RV3 and RV5 to indicate 990.000 Hz and 2.5 V r.m.s.

(22) Reset the dial to 1 and readjust C16 and C17 to give 98.500 Hz and 2.5 V r.m.s.

(23) Repeat (21) and (22) until calibration is achieved. Use an oscilloscope now to check the output.

(24) Reset to range 3 (1 kHz - 10 kHz), set to 'Squarewave' and adjust RV8 to achieve a 1:1 waveform. Adjust RV9 to give 5 V peak-to-peak.

Chapter 6

REPLACEABLE PARTS

CONTENTS

Para.
1 Introduction
2 Ordering

INTRODUCTION

1. Circuit reference numbers are listed in alpha-numerical order. The following abbreviations are used :-

C	capacitor	S	switch
HS	high stability	TH	thermistor
MR	diode	TP	terminal
R	resistor	VT	transistor
RV	variable resistor		

ORDERING

2. When ordering replacements or spare parts, address the order to :-

Marconi Instruments Service Division,
The Airport,
Luton, Bedfordshire, England.

or to your nearest representative. Please specify the following information for each part required.

(1) Type of instrument (TF 2103)
(2) Circuit reference (R1)
(3) Description (3.9 kΩ ±10% $\frac{1}{4}$W resistor)
(4) MI part number (TF 2103/FPP 24001)

Circuit ref.	Description	MI code
C1	2000μF -20% +50% 12V	TF 2103FPP/26001
C2,18	200μF -20% +100% 25V	TF 2103FPP/76002
C3	500μF -20% +100% 25V	TF 2103FPP/26003
C4,9	1.5μF* ±1% 125V	TF 2103FPP/26004
C5,10	0.15μF ±1% 125V	TF 2103FPP/26005
C6,11	0.015μF ±1% 125V	TF 2103FPP/26006
C7,12	1500pF ±1% 125V	TF 2103FPP/26007
C8	60pF ±10% 125V	TF 2103FPP/26008
C13	150pF ±10% 125V	TF 2103FPP/26009
C14	22pF ±10% 125V	TF 2103FPP/26010
C15	270pF ±10% 125V	TF 2103FPP/26011
C16,17	4-60pF (trimmers)	TF 2103FPP/26012
C19,20	33pF ±10% 125V	TF 2103FPP/26013
C21	2000pF ±10% 125V	TF 2103FPP/26014
C22	0.1μF ±20% 150V	TF 2103FPP/26015
C23	0.04μF ±20% 150V	TF 2103FPP/26016
C24**	47pF ±10% 125V	TF 2103FPP/26017

* Value formed by two parallel-connected capacitors.
** Fitted on some models only, between VT8 collector and chassis-earth (on track side).

D1	LED, Litronix RL209	TF 2103 FPP/28601

Circuit ref.	Description	MI code
MR1,2,3,5	Type OA91 (Mullard)	TF 2103FPP/28101
MR4	Type OAZ272 (Mullard)	TF 2103FPP/28102
MR6,7	Type BS920 (Mullard)	TF 2103FPP/28103
R1	3.9kΩ ±10% ¼W	TF 2103FPP/24001
R2, 21,23	3.3kΩ ±10% ¼W	TF 2103FPP/24002
R3	100Ω ±10% ¼W	TF 2103FPP/24003
R4	680Ω ±10% ¼W	TF 2103FPP/24004
R5	10kΩ ±2% ¼W	TF 2103FPP/24005
R6	4.3kΩ ±2% ¼W	TF 2103FPP/24006
R7,17,19,37	47Ω ±10% ¼W	TF 2103FPP/24007
R8	180Ω ±10% ¼W	TF 2103FPP/24008
R9	470Ω ±10% ¼W	TF 2103FPP/24009
R10	1.5kΩ ±10% ¼W	TF 2103FPP/24010
R11	8.2kΩ ±10% ¼W	TF 2103FPP/24011
R12	220Ω ±10% ¼W	TF 2103FPP/24012
R13,31	150Ω ±10% ¼W	TF 2103FPP/24013
R14	1kΩ ±10% ¼W	TF 2103FPP/24014
R15	1.3kΩ ±2% ¼W	TF 2103FPP/24015
R16	1kΩ ±2% ¼W	TF 2103FPP/24016
R18	68Ω ±10% ¼W	TF 2103FPP/24017
R20	47kΩ ±10% ¼W	TF 2103FPP/24018
R22	1.8kΩ ±10% ¼W	TF 2103FPP/24019
R24	10kΩ ±10% ¼W	TF 2103FPP/24020
R25,27	680Ω ±2% ¼W HS	TF 2103FPP/24021
R26	620Ω ±2% ¼W HS	TF 2103FPP/24022
R28,29,30	5.6kΩ ±2% ¼W HS	TF 2103FPP/24023
R32,33	470kΩ ±10% ¼W	TF 2103FPP/24024

Circuit ref.	Description	MI code
RV1, 3, 5, 6	1kΩ (Plessey)	TF 2103FPP/25001
RV2/4 (ganged)	10kΩ per section (Colvern)	TF 2103FPP/25002
RV7	2.2kΩ (Plessey)	TF 2103FPP/25003
RV8	68kΩ (Plessey)	TF 2103FPP/25004
RV9	6.8kΩ (Plessey)	TF 2103FPP/25005
RV10	1kΩ (Colvern)	TF 2103FPP/25006
SA (1-2)	2-pole, 5" (rotary)	TF 2103FPP/23101
SB (1-3)+SC(1-3)	2x3-pole, 2W (push-button)	TF 2103FPP/23102
SD (1-3) to SH (1-3)	5x3-pole, 2W (push-button)	TF 2103FPP/23103
SJ	Open push-button	TF 2103FPP/23104
TH1	Type R23 (STC)	TF 2103FPP/24025
TP1	Black	TF 2103FPP/23001
TP2	Red	TF 2103FPP/23002
VT1, 3, 4, 5	Type AF124 (Mullard)	TF 2103FPP/28201
VT2, 6	Type 2N706 (STC)	TF 2103FPP/28202
VT7, 8	Type 2N711 (Texas)	TF 2103FPP/28203

Chapter 7

SERVICING DIAGRAMS

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Para.
1 Circuit notes
1 Component values
2 Rotary switches
3 Push-button switches

ILLUSTRATIONS

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1 Circuit diagram of TF 2103 (with TM 9808) 3/4

CIRCUIT NOTES

Component values

1. Resistors : no suffix = ohms, k = kilohms, M = megohms.
Capacitors : no suffix = microfarads, p = picofarads.

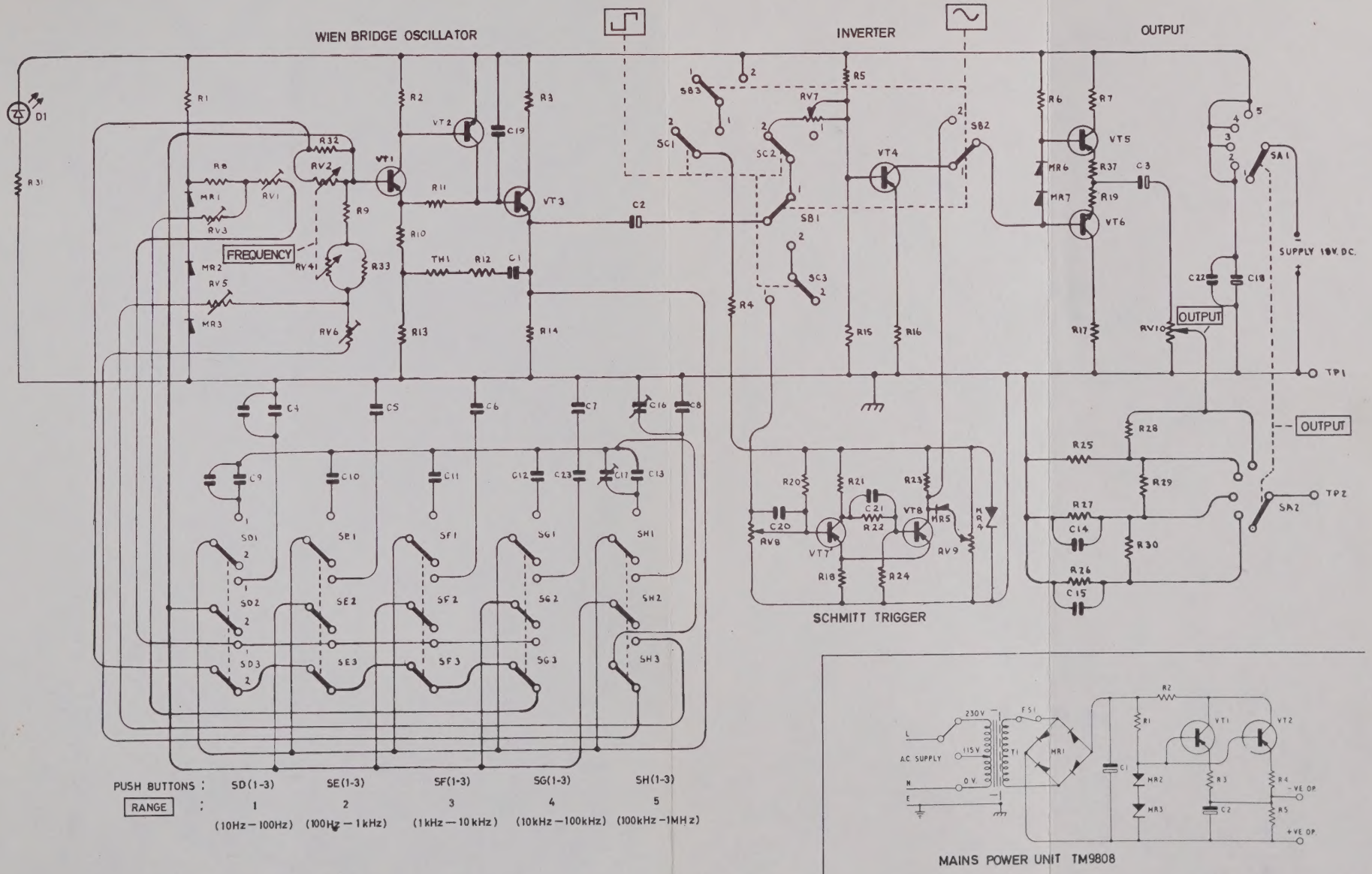
Rotary switches

2. Switches are drawn in their fully clockwise position as viewed from the knob end.

Push-button switches

3. Position 1 = depressed (in)

Position 2 = normal (out)



Circuit diagram of TF 2103

Fig. 1

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